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# Financing Infrastructure in Developing Countries

## Lessons from the Railway Age

*Barry Eichengreen*

Background paper for *World Development Report 1994*

The countries that stand to gain most from investments in infrastructure (transportation, communication, and power generation) are often the countries least able to finance them — yet their income and productivity are often depressed for lack of that same infrastructure. Eichengreen looks to the nineteenth century to identify ways to break out of this low-level equilibrium trap.

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## Summary findings

Arguments for financing infrastructure development through government subsidies and foreign borrowing meet with increasing skepticism. Numerous "white elephants" subsidized by governments have strengthened doubts about the efficacy of public finance, and the debt-servicing problems of the 1980s have weakened arguments for foreign borrowing.

Recent innovative suggestions for financing infrastructure investments in developing countries have a back-to-the-future quality. At the heart of the nineteenth-century debate on financing infrastructure development — especially railways — lay certain concepts: relying on private finance, encouraging the growth of domestic financial markets, and choosing financial instruments that minimize the risk of dependence on foreign funds. Eichengreen reviews the historical record in an attempt to glean lessons for developing countries today.

In the nineteenth century, much as in many of today's less developed and less liberalized economies, not all the

informational and contractual preconditions for efficient private or commercial finance of infrastructure projects prevailed. In some regions, it was difficult to tap investors at home or abroad. Many countries lacked the private institutions (such as universal banks) and public ones (such as regulatory agencies) needed to facilitate monitoring, to discipline management, and to ensure an adequate flow of information to investors.

In places as diverse as Canada, India, Spain, and the United States, getting enough finance often required that the government provide collateral (land grants) and bond guarantees — especially where asymmetric information caused credit rationing.

The main lesson: Exploiting nontraditional approaches to financing infrastructure investment requires action on two fronts: liberalizing and developing domestic financial markets, and reforming administrative mechanisms that ensure accountability from enterprises enjoying government subsidies or guarantees.

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# Financing Infrastructure in Developing Countries

## Lessons from the Railway Age

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For low-income countries, infrastructure investments have the most alluring benefits but also the most prohibitive costs. Where transportation, communication, and power generation are least adequate, their provision can do the most to boost productivity and stimulate growth. But where income and productivity are depressed by the inadequate provision of infrastructure, the financial resources needed to underwrite infrastructure investments are the most difficult to mobilize. With the lack of infrastructure limiting finance and the lack of finance limiting infrastructure investment, countries can find themselves in a low-level equilibrium trap from which it is difficult to escape.

Two obvious possibilities for break out of this trap are government subsidies and foreign borrowing. When the social returns to investment exceed private returns, subsidies can be justified on efficiency grounds. The classic efficiency argument for subsidies applies if a bit of infrastructure investment increases productivity and profitability, igniting a process of self-sustained growth only a fraction of whose benefits are captured by those who finance the initial investment. Even if the returns are appropriable, investment may still not pay when the cost of domestic funds is high, because the supply of savings is low or domestic capital markets are imperfect. Investors may then seek finance abroad where its cost is lower. Where all these conditions apply government guarantees and foreign finance will be the norm.

These familiar arguments for government intervention and foreign borrowing have met with growing skepticism in recent years. The "white elephants" subsidized by governments have underscored doubts about the efficacy of public finance. The debt-

**servicing difficulties experienced by developing countries in the 1980s have raised questions about the desirability of external borrowing. Both observations encourage proposals to commercialize and privatize infrastructure initiatives and to fund them by encouraging the development of domestic financial markets.**

**There is nothing new about either these arguments or these reservations.**

**Infrastructure projects were privately financed and privately constructed in virtually all the regions that began to develop in the wake of European industrialization in the 19th century. (The relatively modest contribution of the federal government to public works is illustrated for the post-Civil War U.S. in table 1.) At the same time, government subsidies and external finance were integral to the process of infrastructure investment. In the United States, to take a prominent example, early railway lines were essentially private undertakings. But land grants and government guarantees subsidized their construction. Finance was raised abroad, mainly on the London capital market. The cost of many early American railways exceeded their benefits not just in the early years but in present-value terms, causing the debtors—including the states that had guaranteed the bonds—to default, permanently damaging their creditworthiness.**

**The goal of this paper is to elucidate the patterns of public intervention and external finance. Its premise is that these patterns are consequences of the structural characteristics of markets in countries in the early stages of economic development. Government intervention, external finance and subsequent difficulties are all correlates of the financial market imperfections that give rise to informational asymmetry, moral hazard, and adverse selection, while government policies to overcome asymmetric information can give rise to the problem**

**Table 1. Federal public works expenditures in the United States, 1866-1882  
(in million of dollars)**

	1866	1870	1875	1880	1882
Roads and canals	0.1	...	0.1	0.1	0.1
Forts, armories, and so on	2.2	1.3	1.4	0.3	0.4
Light stations, and so on	1.4	2.6	2.9	2.4	2.4
Public buildings	0.3	2.2	8.6	2.8	2.8
Rivers and harbors	0.3	3.5	6.4	8.1	11.6
Total	\$4.3	\$9.6	\$19.4	\$13.8	17.3

Source: Studenski and Kroos, 1952, p. 165.

Akerlof and Romer (1993) refer to as "looting," when promoters engage in bankruptcy for profit without significant shareholder resistance.<sup>1</sup> Incomplete information, moral hazard, adverse selection, and looting are not limited to developing countries, of course. But the historical evolution of the present high income countries and the parallels between their situation in the 19th century and that of developing countries today suggest that such problems are especially pervasive during the early stages of economic development.

The remainder of this paper is organized as follows. The first section after the introduction introduces some theoretical considerations centering on the interaction between informational asymmetries, moral hazard, and adverse selection. These factors, it is shown, can give rise to credit rationing and account for observed differences across countries in the structure of investment finance. The second section introduces the financial and economic

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<sup>1</sup> This is similar to the problem of management diversion of profits emphasized by Jensen and Meckling (1976), although in the Akerlof-Romer model it is exacerbated by reduction in shareholder monitoring incentives caused by the government guarantee.

environment in which firms and governments operated during the 19th century, considering both the nature of risks and the mechanisms used to ameliorate them. The fourth Section describes the financial arrangements that grew up in response. Evidence is drawn from experience with infrastructure investments as diverse as turnpikes, canals and docks, tramways, and electrical and lighting systems, though railways command center stage. The railways were the most prominent and capital-intensive infrastructure investments of the 19th century. They forged unified national markets, linked domestic producers to the expanding world economy, facilitated the development of modern high-speed-throughput production techniques, and provided a hotbed for the adoption of modern management practices. For all these reasons they deserve the prominence they have long attracted in histories of economic development.<sup>2</sup>

The fifth and sixth sections consider two devices used to subsidize infrastructure investment to attract foreign finance: the government guarantee and the land grant. They show how these worked to relax the credit-rationing constraint but at the same weakened the incentive for creditors to monitor management, encouraging the latter to divert resources into unproductive uses. The seventh and eighth sections consider the implications for growth of 19th century infrastructure investments, distinguishing social from private returns. The last section draws out the lessons for today's developing countries.

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<sup>2</sup> Any attempt to argue the importance of railways must confront Fogel's (1964) conclusion that the social savings due to railway construction in the U.S. were small. Fogel's figures consider only social savings due to freight haulage, however, neglecting passenger traffic. And given differences across countries in geography and topography, subsequent studies have yielded much larger estimates for other parts of the world. Nor do social savings calculations attempt to quantify the dynamic effects emphasized by authors as diverse as Jenks (1944), Chandler (1965) and Williamson (1974).

## **Theoretical Considerations**

According to the Modigliani-Miller Theorem, investors should be indifferent about the composition of finance. If a firm is highly leveraged (it issues a high ratio of debt to equity), investors can offset this by adjusting the composition of their own portfolios. In the simplest model, the structure of finance is irrelevant to investment decisions.

In the real world there are several reasons why this strong result might not apply, bankruptcy costs being the most relevant to this discussion.<sup>3</sup> In their presence, the returns to bond- and shareholders are asymmetrically distributed. The bondholder cannot earn more than the rate of return specified in the bond covenant but may earn less in the event of default.<sup>4</sup> His return is truncated upward. The equity holder cannot lose more than his stake (assuming limited liability) but stands to make large profits in the event of a positive outcome. His return is truncated downward. The riskier a project, the higher the probability of bankruptcy and subnormal returns for bondholders, and the higher the probability of excess profits and super-normal returns for equity holders.<sup>5</sup>

In the absence of symmetric information, then, the interests of bond and equity holders diverge, and they may find it difficult to conclude a mutually-acceptable contract. Assume, for example, that the entrepreneur knows the probability of failure but that

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<sup>3</sup> See Keeton (1979) and Stiglitz and Weiss (1981). Tax effects are the other prominent reason why the Modigliani-Miller Theorem might not hold.

<sup>4</sup> This statement ignores capital gains due to changes in interest rates economy-wide and puts aside increases in bond prices due to prior fears or occurrence of default.

<sup>5</sup> This assumes a given expected rate of return.



purchasers of his debt do not. As long as all projects yield the same expected return and investors are risk neutral, entrepreneurs with riskier projects will be willing to pay more for a loan.<sup>6</sup> Since information is asymmetric, adverse selection arises: as the interest rate rises, entrepreneurs with safer projects drop out of the pool of potential borrowers. Moral hazard results, because by raising the interest rate the lender encourages the borrower to undertake risky investments. Increasing the interest rate may therefore reduce the lender's expected return. Asymmetric information thus makes it optimal for lenders to ration credit.

In this model, credit rationing is an increasing function of the riskiness of the underlying environment and the severity of barriers to the dissemination of information. The greater the dispersion of returns (the riskier the environment), the greater the risk of bankruptcy and the more likely the composition of finance will matter.<sup>7</sup> In a world where all returns are the same, moral hazard and adverse selection cannot arise. And the more costly it is to sort projects by probability class (the greater the informational asymmetries), the more serious the problem of adverse selection and moral hazard. Many present-day developing countries are prime candidates on both grounds, because their volatile economies lack effective financial disclosure requirements and alternative signalling mechanisms. The same was true of industrializing countries outside of Europe in the 19<sup>th</sup> century.

Asymmetric information, adverse selection, and moral hazard force entrepreneurs with risky but potentially profitable projects to commit their own wealth by subscribing

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<sup>6</sup> Since all projects yield the same expected return, riskier projects (which yield nothing in the event of failure) yield a higher return in the event of success. Hence, in the event of success entrepreneurs with riskier projects can afford to pay a higher interest rate.

<sup>7</sup> I continue to assume a uniform expected rate of return.

shares. The greater these problems, the more share capital will have to be subscribed before debt finance can be obtained.

De Menza and Webb (1987) have shown that the level of investment in this equilibrium will be socially suboptimal. In the first best equilibrium with risk-neutral investors, all projects with expected returns equal to the world interest rate should be undertaken. But some of these projects will not be financed when information is distributed asymmetrically. The first-best equilibrium can then be restored if the government provides an interest subsidy.

An interest subsidy or guarantee can give rise to other problems, however. Though extension of a government guarantee can relax the credit constraint, it will also remove the incentive for bondholders to monitor firm performance. This permits management to divert resources to nonproductive uses from which it benefits, (Jensen and Meckling, 1976). In the extreme, promoters have an incentive to engage in bankruptcy for profit. As Akerlof and Romer (1993) show, in the presence of permissive public sector supervision promoters will inflate accounting rates of return relative to economic returns, diverting the enterprise's resources into their own pockets. If bankruptcy results, government, and ultimately, the taxpayer will be left holding the bag. This problem will be most prevalent where government oversight is lax and where promoters and their confederates attach least value to reputational capital.

## **The Environment for 19th Century Infrastructure Investment**

Infrastructure investment in the developing countries involves a considerable element of risk. This reflects four factors common to such settings: the novelty of the technology, the relatively long gestation period prior to reaping returns on investment, uncertain prospects for local market growth, and the lack of reputation of aspiring promoters. All four problems were severe in the 19th century.

### ***Sources of Risk***

Initially, there were few places other than England to which potential investors in infrastructure projects could turn for information on required outlays and expected returns. Hence, a single prominent project like the Erie Canal, so profitably built by New York State in the 1820s, could have a powerful impact on the operation of the capital market.<sup>8</sup> The Erie's success thus set off a canal-building boom that engulfed the mid-Atlantic and New England coasts.

Many of the technologies involved were new and unfamiliar. The costs of building a canal connecting Buffalo with Lake Erie or crossing the rolling English countryside provided limited guidance to those seeking to estimate the costs of surmounting the higher mountains of western Pennsylvania. It is no coincidence, then, that the canals of Pennsylvania and Maryland turned out to be more expensive than anticipated and were never profitable. Similarly, information gleaned from experience with canal building was of limited use at the

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<sup>8</sup> The Canal was completed in 1825 at a total cost of \$11 million, \$3 million of which came from current sources and \$8 million of which came from long-term loans. It was able to meet current interest payments on the debt in its first year of operation and was paid off fully within ten years.

outset of the railway age.<sup>9</sup>

Though even in Europe only incomplete information was available regarding economic conditions, the problem was most severe in overseas regions of recent European settlement. For regions like the North American West that had only recently appeared on maps, not even geography could be taken for granted: one writer recalls a dinner in London where a British investor asked an American visitor whether Cincinnati or Ohio was the larger city.

The amount of traffic a railway would attract was contingent on the economic development of the adjoining region, which depended on imponderables such as the fertility of the soil, the reliability of rainfall, and the extent of mineral reserves. "Want of local knowledge" was cited in 1852 by the chairman of the Madras Company as an obstacle to attracting external finance for railroad building in India.<sup>10</sup> Where the volume of traffic ultimately depended on the extent of mineral deposits, uncertainty about reserves posed a formidable risk; North American railways were built or not built on the basis of crude forecasts of coal or silver deposits. Where land had to be settled, cleared, and irrigated before it could be farmed, many years might be required before the picture was clarified. Canadian railway building peaked in the final decades of the 19th century but significantly stimulated wheat production (and rail traffic) only in the second decade of the 20th century.<sup>11</sup> Even where settlement was not at issue, years might have to pass before

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<sup>9</sup> It was similarly problematic to extrapolate from experience with gas-burning lamps to determine the costs and benefits of electrification.

<sup>10</sup> MacPherson (1955, p.180).

<sup>11</sup> Ankli (1980, p.260 and *passim*).

economic activity and the volume of traffic responded. An Indian official in 1846 cited the long gestation period before profits could be expected as a particular impediment to railway investment.<sup>12</sup>

Foreign investors could be discouraged as well by uncertainty about political stability. The hesitancy of foreign investors to place their funds in the United States lingered into the 1870s, well after the conclusion of the American Civil War. The unfortunate name given to the 1857 rebellion in India ("the Mutiny") represented a persistent impediment to borrowing.<sup>13</sup>

Along with the economic prospects of the project, it was necessary to evaluate the promoter undertaking it. Recently settled, sparsely populated areas were prime locations for fly-by-night operators. Promoters could strike sweetheart deals with construction companies, siphoning off the resources of the project and saddling it with an insupportable debt burden. This danger represented a clear impediment to investment.

### *Means of Reducing Risk*

An obvious way of reducing these risks was to exploit the informational advantage possessed by local investors. Countries with precious industrial and commercial development could possibly finance infrastructure investment through a limited partnership of wealthy residents who were well informed about local prospects. Early turnpikes, canals and railroads had modest capital requirements compared with the long-distance rail lines that

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<sup>12</sup> MacPherson (1980, pp.180-181).

<sup>13</sup> MacPherson (1955, p.180).

would follow. A locally-based limited partnership might therefore suffice to raise the requisite capital.

New England, the center of American textile manufacturing and hence of American industry in the early 19th century, illustrates the point. The growing number of small industrial towns provided a fertile field for short-haul railroads.<sup>14</sup> New England was also the center of American commerce, shipping, and whaling. Important Boston traders specialized in the China trade, through which they learned how to use entrepreneurial and managerial techniques to overcome long spans of time and distance.<sup>15</sup>

Much New England railway finance was raised in the same way that the region financed its textile mills, namely by relying on family, friends, and personal contacts. Where contract enforcement was problematic and information was difficult to verify independently, the markets made heavy use of such links.<sup>16</sup> Friends and associates would vest their confidence in individual financiers with reputations for honest dealing who signalled their commitment by putting their own funds at risk.<sup>17</sup> The danger of looting by fly-by-night operators was correspondingly reduced.

The great majority of early American railway shares were subscribed by relatively sophisticated local manufacturers, farmers, landowners, bankers, merchants, and contractors. Not only did these individuals have superior access to information, but they stood to benefit

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<sup>14</sup> Chandler (1954, p.255).

<sup>15</sup> Johnson and Supple (1967, p.30).

<sup>16</sup> For details, see Lamoreaux (1986).

<sup>17</sup> Baskin (1988, p.210). As Johnson and Supple (1967, p.338) put it, "investment tended to be a cumulative social process in an environment lacking an impersonal, national money market."

the externalities associated with the construction of transportation links.<sup>18</sup> Many early syndicates were led by textile producers seeking roads that would serve their mills and Boston merchants looking to railroads as a link with the hinterland market and the Great Lakes.

This model was difficult to generalize, however, because the capital requirements of early railways were more modest than their successors and the funds available in New England exceeded those of other developing regions, which had to seek external finance. Railway shares and bonds tended to be traded in distant markets before such trade developed in the liabilities of manufacturing and commercial concerns. Manufacturing used more exotic technologies, and commercial undertakings had less tangible forms of capital (receivables, for example). This required greater sophistication of investors. It was more straightforward to compare the costs and quality of railroad construction traversing similar terrains than the intangible informational capital of a mercantile company. The railways were thus among the first enterprises to access external finance on a significant scale.<sup>19</sup> As early as the 1830s, a number of railway lines around Philadelphia and several lines in Virginia and North Carolina were able to market bonds in London.<sup>20</sup> The pattern persisted: as late as 1914 railway bonds accounted for perhaps half of all outstanding foreign investments in the United States.<sup>21</sup>

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<sup>18</sup> Platt (1984, p.156).

<sup>19</sup> Baskin (1988, p.211).

<sup>20</sup> Adler (1970, pp.10-11).

<sup>21</sup> Woodruff (1967, p.119).

In terms of accessing external funds, railroads benefitted from the fact that some of the knowledge needed to evaluate project risk could be transferred across space. External finance of British railways was relatively well advanced; the experience of British investors helped them to evaluate the prospects of American lines.<sup>22</sup>

Notwithstanding these advantages, external investors were still handicapped by incomplete information.<sup>23</sup> This led them to shun common shares. Prior to the 1850s foreign investors underwrote U.S. railways primarily by purchasing government bonds that were issued to help finance railway construction. Only New Englanders investing in western and southern railways were inclined to purchase securities issued by the railways themselves.

Boston began in the 1840s to invest in the roads of the U.S. South and West through personal contacts. Railroad men coming to Boston contacted merchants who had invested previously in local railroads. The promoters invested their own money, signalling their commitment, "and talked friends and close business acquaintances into taking shares in it."<sup>24</sup> Long-term relations between western promoters and Boston merchants and between the merchants and their personal contacts provided a reliable conduit for information about investment projects and their promoters.

Luring overseas investors required the intermediation of specialized institutions that had grown up in the London market: issue houses, private banks, bill brokers, and financial

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<sup>22</sup> Baskin (1988, p.212).

<sup>23</sup> I refer to "external" rather than "foreign" investors for two reasons. First, countries such as Canada and India which were not independent relied on external finance from the colonial center, Great Britain. Second, late developing regions in continental economies like the Western United States relied on external finance from earlier developing regions such as New England.

<sup>24</sup> Nicholas Biddle and other merchants and bankers played a similar role in Philadelphia. Chandler (1954, p.259).



investment companies. (The importance of these various institutions is summarized in table 2.) In the 1820s and 1830s British investors purchased American state securities and canal bonds recommended by Samuel Gurney, the Quaker bill broker, and American Joshua Bates, managing partner of Baring Brothers from 1825 to 1864. The head of a British investment banking firm like Barings would only occasionally visit the region in which the investment took place but retained an American agent to monitor developments. Here, too, personal contacts mattered: Barings replaced its first American agent, T.W. Ward, with his son, Samuel Gray Ward.

**Table 2. Proportion of Overseas New Issues Introduced by the Main Types of Issuing Houses, 1870-1914**

	Official and semi- official agencies	Private banks <sup>a</sup>	Joint-stock banks	Overseas banks and agencies	Companies via their bankers	Other media <sup>b</sup>	Total amount issued (£millions)
1870-74	1.8	53.0	4.4	9.6	18.2	13.0	390.6
1875-79	14.5	36.5	0.8	24.7	13.0	10.5	149.2
1880-84	6.7	38.5	3.3	14.1	26.7	10.7	355.3
1885-89	9.9	43.7	5.3	7.5	26.1	7.5	479.2
1890-94	10.4	46.4	9.0	8.8	19.6	5.8	349.6
1895-99	8.7	25.1	11.2	20.3	25.2	9.5	359.6
1900-04	27.4	19.2	17.8	14.4	16.7	4.5	258.2
1905-09	10.3	32.7	12.2	22.4	18.7	3.7	509.9
1910-14	8.3	35.2	17.4	18.8	17.5	2.8	783.8
1870-1914	9.8	37.2	10.3	15.4	20.5	6.8	--
Total amount issued (£millions)	355	1,354	371	562	746	248	3,636

a. For example, merchant bankers

b. Comprising: investment trust (£23million); finance, land, and property companies (£18 million); special purpose syndicates (£41 million); issue house with stock exchange connections (£22 million); companies as their own issuers (£13million); and miscellaneous issuers (£131 million).

Source: Based on a table prepared by W.A. Brown published in *The Economist* (November 20, 1937) and reprinted in Balough, 1947: 233.

The leading investment houses specialized in recommending only the highest quality foreign bonds. To signal their commitment to this advice, they bought the same bonds for

their own portfolios. Typically, these were bonds of roads backed by state government credit or bonds that were particularly well known and long established. Many British investors limited their purchases to a few large eastern companies for which information problems regarding western companies were least severe.<sup>25</sup>

Other Europeans (mainly the French, Swiss, and Germans) invested more widely but conducted less business with European-based intermediaries like Barings, relying instead on American investment houses. Rather than pairing them up with institutional partners in the home country as the British did, these Europeans dispatched to America a representative to examine the prospective investment in order to ascertain the value of the securities.<sup>26</sup> The immigrant community formed another conduit for information. Specialized publications such as *The American Railroad Journal* and *Poor's Manual of the Railroads of the United States* also provided information for investors. From the 1860s, British investors organized themselves as the Council of Foreign Bondholders and the English Association of American Bond and Shareholders to collect information on arrears and negotiate with debtors. Protective organizations were established also in France, Germany, and Holland.<sup>27</sup>

Though most American railway bonds were sold privately, a secondary market in these securities had sprung up by the 1850s. Increasingly investors turned their attention from bonds to common shares. Stocks were not marketed by the usual issuing agencies; they

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<sup>25</sup> Adler (1970, p.66-67).

<sup>26</sup> Adler (1970, p.47).

<sup>27</sup> On the operations of the Council of Foreign Bondholders, see Eichengreen and Portes (1989). Wilkins (1989) notes that the newspaper files of the Council include 25 volumes devoted to American railways.

had to be obtained from American railway offices in England or, more commonly, from jobbers and dealers who purchased blocks in the U.S. for sale in Europe. Initially, only the most reputable issues were traded on the London Stock Exchange. Their numbers grew quickly, however. The directors of the Exchange provided only a weak filter for dealing with problems of asymmetric information: "Before 1914 the Stock Exchange made no attempt to restrict or control in any way the right to deal in any security, whether British or foreign....it was in general more concerned with arrangements to ensure a reasonably free market in the securities than with the intrinsic merits of the company or with the adequacy or accuracy of the information provided."<sup>28</sup> The Exchange's ability to restrict entry was limited by competition from provincial exchanges and outside brokers and bucket shops. From the mid-1880s *The Economist* began to publish quotations for American rails not listed on the London Exchange but nonetheless extensively traded.<sup>29</sup>

In addition to personal contacts and specialized investment brokers, foreign investors relied on the signal of third-country management. A substantial share of late 19th century British investment in Latin America was in enterprises controlled by Americans and Canadians. North American investors faced the same risks as their British counterparts but, enjoyed advantages of proximity especially in the cases of Mexico and Panama (still officially Colombia). Prior U.S. and Canadian borrowing had established links with the London market that could now be used to channel information from Latin America back to Britain.

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<sup>28</sup> Paish (1951, p.4).

<sup>29</sup> Adler (1970, p.158). Trading on other European exchanges was active as well. As early as 1875, 63 U.S. railway issues were listed on the Amsterdam Exchange. Wilkins (1989, p.202). U.S. railway shares were also actively traded in Berlin, Paris, Geneva, Zurich, Basle, Brussels, and Antwerp.

The involvement of Americans and Canadians with whom British investors had long-term relationships maximized information capital and prevented British foreign investments from being looted. British investors took shares in Canadian-controlled public utilities, tramways, and railways throughout the Western Hemisphere. On the eve of World War I, Canadian-controlled enterprises represented more than half of all British portfolio investment in private industry in Latin America and nearly half of all British public utility capital invested there.<sup>30</sup>

Risk could remain even where information was not a problem, given the uncertain prospects of the regions of recent settlement. Large investors could eliminate the unsystematic component of this risk by holding diversified portfolios of railway bonds. British, German, Russian and Canadian insurance companies, which invested heavily in U.S. railway bonds, could follow this strategy. So could English and Scottish commercial banks, many of which held substantial portfolios of American railway bonds.<sup>31</sup> Similar opportunities were offered to smaller investors by investment trust companies, the equivalent of modern mutual funds. Most of the early trusts were unincorporated. Shares were typically issued in £100 denominations. The first investment trust, the Foreign and Colonial Government Trust established in London in 1868, spawned a number of imitators. In 1873 its five trustees founded the first trust company devoted solely to investment in American railway securities. Some trusts followed highly conservative investment strategies, investing exclusively in high grade bonds, while others branched into more speculative activities like

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<sup>30</sup> Stone (1977, p.715).

<sup>31</sup> See Goodhart (1972).

the underwriting business, floating railway securities themselves.

### **Patterns of Infrastructure Finance**

These institutional structures, superimposed on an environment of asymmetric information, yielded a predictable pattern of infrastructure finance. Not every piece of infrastructure was financed in the same way, but the exceptions to the pattern and the distinctive features of the projects with which they were associated yield useful information on the operation of contemporary markets.

Early infrastructure investments were almost always financed locally.<sup>32</sup> Residents had the most complete knowledge of local economic prospects; local finance, by limiting asymmetric information, minimized problems of adverse selection and moral hazard. Local residents had long-term relationships with the promoters, whose reputational capital would have been put at risk by looting.

Not surprisingly, then, early New England railways were financed almost entirely out of equity.<sup>33</sup> Significantly, however, these projects were relatively modest, only connecting Boston with Portsmouth or Providence. A more ambitious railroad built in the late 1930s and early 1940s, the Western Railroad linking Boston with Albany, had 2000 stockholders, more than half of whom were located in Boston. Only 17 percent had 100 or more shares as

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<sup>32</sup> Platt (1984, p.128 and *passim*) insists on this fact.

<sup>33</sup> Johnson and Supple (1967, p.36).

of 1841.<sup>34</sup> Another example is the early Spanish railways, which were financed domestically from the 1840s. Although foreign financiers, entrepreneurs, and engineers took part, the major share of capital was Spanish.<sup>35</sup>

The underdeveloped state of markets could, however, pose an obstacle to mobilizing local finance. One example of the difficulties presented by imperfect commodity and capital markets was the attempt to market bonds for the St. Lawrence and Atlantic Railway in Canada in the 1840s. Some of the Canadian subscriptions were paid in the form of pork and eggs for the sustenance of construction gangs, since many farmers lacked cash. Certain early U.S. railways similarly took subscriptions in the form of labor and materials.<sup>36</sup>

These early railways were short and cheap and hence had relatively modest capital requirements. The transition from turnpikes to canals and then to long-haul railways over time made it necessary to raise more funds than could be mobilized locally. External finance was not a substitute for local finance; rather, it was a supplement. Locals still needed to put up capital as collateral in order to indicate their willingness to "put their money where their mouths were." External investors could then be assured that those in the best position to assess the needs of the project and monitor its progress and the actions of its promoters would in fact do so.

External finance for infrastructure investment might come from more advanced areas within the same country, as in the case of New England's investments in the U.S. South and

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<sup>34</sup> To continue the road from the state line to Albany, the city of Albany subscribed the entire capital stock, paying for it with city bonds. Johnson and Supple (1967, p.43).

<sup>35</sup> Wais (1974, p.159).

<sup>36</sup> Easterbrook and Aitken (1961, p.297); Cleveland and Powell (1912, p.30).

West. Where advanced regions did not exist and the capital requirements of the project exceeded the resources that could be mobilized elsewhere in the country, promoters and governments engaged in borrowing overseas. Where as the short, cheap Spanish railways of the 1840s were heavily financed by local interests, their more ambitious successors, such as the Norte and the M.Z.A., found about half of their capital in France.<sup>37</sup>

The financial instruments employed varied with economic and geographical distance. Nearby lenders, such as New Englanders lending to the American West, often purchased common stock because personal and business contacts provided a reasonably reliable flow of information. Some of the short, inexpensively-built lines of central New York were able to supplement local subscriptions with sales of stock in New York City.<sup>38</sup> A substantial block of shares in Canada's Welland Canal, built in the late 1820s and 1830s to circumvent Niagara Falls and open Montreal to western trade, was purchased by a group of investors in New York State. This was the only Canadian canal which attracted significant foreign investment; proximity to New York and the state's experience with the Erie Canal played a facilitating role.<sup>39</sup> British investors in American railways, whose economic distance was reduced by institutions such as investment houses and stock brokers, often preferred stock as well.<sup>40</sup>

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<sup>37</sup> Platt (1984, p.129).

<sup>38</sup> Trading in these shares played a central role in early development of the New York Stock Exchange. Chandler (1954, p.254).

<sup>39</sup> Ultimately, revenues proved insufficient to pay for maintenance. In 1837 the provincial government took effective control of the canal and formal ownership passed to it in 1841.

<sup>40</sup> Estimates for years around the end of the prewar period nonetheless suggest that the majority of British investments in American rails took the form of bonds. See for example Lewis (1938), who suggests that the value of British holdings in bonds, around 1914, was two and one-half times the value of shares.

Others more typically invested in bonds, which were less risky than the residual claim of common stock.<sup>41</sup> Ambitious infrastructure projects such as long-haul railways relied primarily on bonded debt. A very few railways, for example certain early southern lines, were able to issue stock, but these relied on the municipal guarantees of cities like Charleston and Savannah.<sup>42</sup> In the case of Spain, foreign investors avoided stock, despite the fact it was widely traded in Barcelona. Common stock represented only 40 percent of Spanish railway capital as of 1864.

American railway bonds could run 30, 40, 50 or even 100 years to maturity.<sup>43</sup> They were secured by mortgages on the railroad's property or enjoyed a government guarantee. Many lines issued bonds that could be converted into stock at the holder's option. With time, this "long-term convertible mortgage bond" became the standard investment vehicle for American railways.<sup>44</sup> According to Adler (1970), all but one of the American railway issues that found favor in London before 1852 were convertible bonds.

One of the extra risks faced by foreign investors was that posed by exchange rate fluctuations. Illustrations from the United States occurred in the suspension period during and immediately following its Civil War and in the 1890s, when doubts about the stability of the dollar exchange rate resurfaced. Latin American countries experienced even more

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Other contemporary estimates put the ratio as high as nine to one. See Wilkins (1989, p.725).

<sup>41</sup> Chandler (1954, p.248). As Jacob Schiff of Kohn, Loeb put the point in 1913, "stocks go wrong more frequently than bonds." Cited in Wilkins (1989, p.725).

<sup>42</sup> Chandler (1954, p.250-251). More information on government guarantees follows in the next section.

<sup>43</sup> Wilkins (1989, p.725).

<sup>44</sup> Chandler (1954, p.250-251).



frequent bouts of exchange rate instability. A few well-established railways of the eastern United States, such as the New York-Wilmington lines and the Pennsylvania coal roads, were able to issue sterling bonds. Lower interest could be offered on those bonds because exchange risk was absent.<sup>45</sup> Thus, once the Michigan Central had proven its viability, it was able to issue six percent sterling bonds rather than eight percent convertible bonds.<sup>46</sup> But this was feasible only for railways with steady incomes and ample reserves.

The problem with relying on bonds, as foreign investors in infrastructure projects did in the second half of the 19th century, was that, in the prevailing environment of imperfect information, adverse selection and moral hazard increased with leverage. The portfolio of projects contemplating debt finance grew riskier as the interest rate rose. Promoters had an incentive to take on excessive debt (to water their stock), because they stood to make huge profits through leverage if they succeeded but could lose no more than their equity stake if they failed.

Contemporaries consequently complained that many worthwhile investment projects could not raise external finance. This credit rationing created an obvious argument for government intervention.

### *Government Guarantees*

"When great schemes of public utility are brought before the country," wrote *The Economist* in 1858, "it is natural that the Government should extend its aid to such

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<sup>45</sup> Some also issued gold bonds, interest and principal on which was payable in gold.

<sup>46</sup> Adler (1970, p.55-56).

enterprises."<sup>47</sup> The premise was that the social benefits of such projects might exceed the private returns.<sup>48</sup> Promoters employed this argument to their advantage, emphasizing the benefits to society that would result from the successful completion of such investments.

In the case of infrastructure investments, government aid took the form of outright subsidies and aid in kind (often financed by the issue of bonds designated for the purpose or the earmarking of revenues) and guarantees of interest on bonded debt.<sup>49</sup> In Spain, the railways received subventions from the government as well as tax exemptions and tariff concessions on imported rail. Canadian governments borrowed \$20 million for canal purposes in the 1840s alone.<sup>50</sup> In the United States, of the US\$195 million allocated to canal construction between 1815 and 1860, US\$121 was spent by state governments, only \$74 million by private companies.<sup>51</sup> State and local governments were also fundamental subscribers to the securities of the early American railroads. Prior to 1840 nearly all the great east-west projects—both railways and canals—were financed by public bonds. In the case of the Western Railroad Corporation of Massachusetts in the 1830s, for example, the Commonwealth of Massachusetts took a one-third partnership in the railway, which it financed by floating state paper in London.<sup>52</sup> The State of Ohio subscribed one share in its state's railroads for every two shares purchased by private investors. The costs of these

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<sup>47</sup> Cited in MacPherson (1955, p.181).

<sup>48</sup> I report some of the evidence on private and social returns below.

<sup>49</sup> Another form of subsidy, the land grant, is the subject of the next section.

<sup>50</sup> Jenks (1938, p.204).

<sup>51</sup> Cranmer (1960, p.558).

<sup>52</sup> Platt (1984, p.156).

projects were said to be too great and their profits too uncertain to attract adequate private capital.<sup>33</sup> Only the early North-South railways and the Pennsylvania coal roads were paid for largely by bonds of private corporations. These lines were shorter and cheaper to build and more certain of regular traffic.

Subsequent investigations are consistent with the view that railways threw off positive externalities. Fogel's (1960) study of the Union Pacific Railroad in the United States, for example, estimated that the social return averaged 30 percent per annum, two and a half times the private return.<sup>34</sup> Yet it was far from clear that private entrepreneurs were unable to capture these externalities. Adjoining lands whose productivity and value were enhanced by investment in a turnpike, canal, or railway could be and often were purchased by the promoter of the infrastructure project. Textile mills and mercantile enterprises whose profits were boosted by infrastructure investments that provided a steady supply of raw materials to the factory and finished products to the market could be and often were owned by those who organized infrastructure projects. This ability to internalize externalities clearly weakened the case for subsidization.

A second justification for government intervention was to offset information asymmetries and capital market imperfections. Even if social returns could in principle be captured by investors, incomplete information that resulted in credit rationing might prevent them from doing so. Though this rationale receives less attention in the literature, it provides an explanation for the form taken by many subsidies: interest guarantees on

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<sup>33</sup> Chandler (1954, p.249).

<sup>34</sup> Fogel (1960, p.106). I return to this issue of social returns in the section on social impact.

government bonds.<sup>55</sup>

This device was prevalent wherever canal and railway construction took place. In India, for example, if a company did not attain a minimum rate of return (about five percent, at the time) it received compensation for the difference from the Government of India under the terms of "the guarantee." The interest clause in the bond covenant was backed by the government's full powers of taxation. All of India's early railways, including the important lines running inland from the port cities, were built under the guarantee. The less certain the local economic prospects, the more powerful the effects; government guarantees were therefore particularly effective in attracting foreign investors. "The motives of the British investors can be explained almost entirely in terms of the five percent guarantee of interest offered by the Indian Government," as one Indian historian concluded.<sup>56</sup> Without the guarantee, infrastructure projects were impossible to finance.<sup>57</sup> Once the guarantee was provided, however, Indian railways had no difficulty in accessing the widest possible market. The Indian bonds bore interest rates several points above those offered on British consols and were regarded as perfectly safe. Investors included conservative widows, barristers, clergymen, spinsters, bankers, and retired army officers.

In Canada, canal projects in the first half of the 19th century received government

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<sup>55</sup> If credit rationing was the distortion, then an interest guarantee (or subsidy—this section) was the first-best form of intervention. If positive externalities were the distortion, in contrast, there would be no argument for intervening in ways that might affect the firm's capital structure.

<sup>56</sup> MacPherson (1955, p.180).

<sup>57</sup> Because the North Bengal Company was refused a guarantee, it was unable to begin construction and all deposits were returned to shareholders.

guarantees under the aegis of the British Colonial Office.<sup>58</sup> Before 1849, attempts to build railways in Canada had foundered as a result of difficulties in raising capital. That year the legislature passed a scheme for government guarantees of interest at a rate not over six percent on half the bonds of any railway over 75 miles in length, provided that half the railway had already been built.<sup>59</sup> Once the guarantee was secured, Canadian railways were able for the first time to attract significant amounts of foreign finance, mainly through the participation of a few large Boston and New York capitalists already experienced in railway building and management.

The Grand Trunk Pacific, in its time the single largest investment project undertaken in Canada, illustrates the financial structure that might result. On the prairie section from Winnipeg to Wolf Creek, Alberta, the government guaranteed three percent bonds for first mortgages in the amount of \$13,000 a mile. On the remainder it guaranteed similar bonds for 75 percent of the total construction cost. Moreover, for the first seven years the government paid the interest on the bonds it guaranteed.<sup>60</sup> The importance of guarantees grew with the capital requirements of the project. Canada later began the construction of not one but three transcontinental railways, for which considerable amounts of foreign capital were imported (see tables 3 and 4); Glazebrook (1938) concluded that not even one could have been built without government guarantees.

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<sup>58</sup> Jenks (1938, p.199).

<sup>59</sup> Easterbrook and Aitken (1961, p.298).

<sup>60</sup> For details, see Ankli (1980).

**Table 3. Distribution of Total Flow of Capital to Canada, 1900-1914, (millions of dollars)**

	All countries	Great Britain	United States	Other countries
Dominion and provincial governments	179	175	4	--
Municipal governments	260	200	60	--
Railroads	767	670	50	47
Industrial	630	420	180	30
Land and timber	305	80	145	80
Mining	125	65	60	--
Insurance	82	32	50	--
Other	198	111	81	6
Total	2,546	1,753	630	163

Source: Buckley 1955, p.90.

**Table 4. Gross Construction Outlays in Major Transport Fields in Canada, 1901-1930**

Period	Railways	Highways	Canals and harbors	Total
Values (millions of dollars)				
1901-05	124.3	3.3	32.1	159.7
1906-10	380.7	11.7	48.0	440.4
1911-15	537.4	38.5	93.7	669.6
1916-20	252.5	39.4	59.7	351.6
1921-25	253.2	100.4	109.8	463.4
1926-30	389.4	172.4	138.2	700.0
Percentage distribution				
1901-05	77.8	2.1	20.1	100.0
1906-10	86.4	2.7	10.1	100.0
1911-15	80.3	5.7	14.0	100.0
1916-20	71.8	11.2	16.9	100.0
1921-25	54.6	21.7	23.7	100.0
1926-30	55.5	24.6	19.7	100.0

Source: Buckley 1955, p.32.

Government guarantees were not an unmitigated blessing. While they helped railway promoters surmount the problem of credit rationing created by asymmetric information, they also removed the incentive for investors to monitor management performance. Investors no longer stood to lose—or to lose as much—if promoters and their confederates diverted resources from productive uses. This gave the latter an obvious incentive to negotiate sweetheart deals with those responsible for construction and supply in order to channel funds into their own pockets. Because many infrastructure projects were one of a kind, the practice was readily disguised. Reasonable costs of idiosyncratic projects like railway and canal construction are intrinsically difficult to ascertain. Many partners in such projects were only temporarily involved and thus had little reason to be deterred by potential damage to their reputations as promoters. Meanwhile, only those ultimately responsible for the financial liability—or more precisely, their elected representatives—had an incentive to monitor such activity. Guarantees therefore could (and did) give rise to looting.

The prevalence of looting is difficult to verify, given the problem of definitively establishing minimum feasible construction costs. Yet the correlation between cost inflation and bond guarantees for 19th century infrastructure investment is suggestive. Again, Canada's Grand Trunk Railway illustrates the point. Recall that the Canadian government guaranteed first mortgage three percent bonds in the amount of \$13,000 a mile on the prairie section and that it guaranteed similar bonds for 75 percent of the total construction cost on the remainder. Almost immediately the company found itself unable to pay interest on its bonds. To a large degree its problems reflected "unanticipated costs of construction."<sup>61</sup>

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<sup>61</sup> Easterbrook and Aitken (1956, p.309 and *passim*).

Contractors pressed for the construction of new links to the railways of New York and Michigan rather than the use of existing lines. In 1851 Gzowski and Company, a contracting firm run by former directors of railways with connections to the Grand Trunk, was awarded the contracts for the construction of these lines. The contractors received their pay in cash, "and the individual members of the firm realized sizable fortunes."<sup>62</sup> In contrast, British contractors who were dealt with at arm's length received less generous compensation. Overall, construction costs proved much higher than expected. Existing lines were added to the network for "inflated" purchase prices. Operating expenses in the first ten years ranged from 58 to 85 percent of gross receipts instead of the forecasted 40 percent that was typical of other railways. All this is consistent with the predictions of the Akerlof-Romer model—that unlimited government guarantees extended to relax credit-rationing constraints weaken the effectiveness of corporate control if they are not accompanied by effective public sector oversight and regulation.

## Land Grants

Another form of government intervention was land grants. These can be justified on externality grounds; ceding adjoining land to railways and canals allowed promoters to internalize many of the positive externalities thrown off by their investments. An alternative and arguably more accurate interpretation is that land grants corrected capital market imperfections in the same manner as interest guarantees. They provided collateral that could

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<sup>62</sup> Easterbrook and Aitken (1965, p.310).



be used to back bonded debt. Land grants were particularly attractive to governments for which interest guarantees implied the imposition of highly distortionary taxes.

Bonds backed by mortgages on land had minimal bankruptcy costs compared with other bonds. Interest and principal owed to the primary creditors could be paid off through land sales in the event that the investment project failed. The loan was fully collateralized, mitigating the problem of moral hazard and adverse selection that otherwise give rise to credit rationing.<sup>63</sup> This role of land grants is reflected in the fact that the only American railroads that were able to issue regular bonds as opposed to convertible issues received land grants.<sup>64</sup> These securities were issued separately from the other bonded debt of the enterprise. Alternatively, receipts from land sales could be mortgaged, as in the case of the Atchison, Topeka, and Santa Fe railroad, which issued "land income" bonds. This backing was especially attractive to foreign investors for whom monitoring and information gathering was least practical.

In principle, the land grants offered to railways in North America and elsewhere were strictly limited in scope. Compared to an unlimited guarantee, this should have done less to discourage monitoring by outside investors. But railways receiving land grants that subsequently ran into difficulties were often extended interest guarantees and other forms of subsidization. In practice, then, the negative side effects of land grants were no less pronounced than those of bond guarantees.

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<sup>63</sup> At least this was true of early mortgage bonds. Subsequently some promoters issued "collateral trust mortgage bonds" that were secured not by real property but by the stocks and bonds of other companies. See Bryant (1971) for details.

<sup>64</sup> Adler (1970, p.54-55).

The land grant policy was taken to an extreme in North America. Approximately 150 million acres of land was granted to western U.S. railways between 1850 and 1870. The policy was discontinued in 1871 (coincidentally, the same year it was adopted in Canada). The Canadian House of Commons described land grants as a way of subsidizing railway construction without having to raise the rate of taxation. (Defaults on guaranteed bonds in the 1850s and 1860s had led to a painful drain on government revenues.) Initially land was granted in alternating blocks twenty miles deep and six to twelve miles wide, one going to the railroad, the next reserved for the government.

Collateral was most valuable in places with the least adequate information and the greatest potential for moral hazard and adverse selection. In India, for example, the governor-general recommended in 1846 that the East Indian Railway Company be given land and a capital guarantee for a railway to run from Calcutta up the Ganges, a venture too speculative to be supported by private subscriptions alone. Parliament considered the question, concluding that if the East India Company was going to give subsidies to any railway, preference should be given to one that would benefit cotton. After months of discussion it was decided to give land and interest guarantees to several "experimental lines."<sup>65</sup>

The U.S. land grant policy has been studied in detail. Fishlow (1965) estimates that the land subsidy amounted to roughly five percent of total U.S. railroad investment during 1850-1880. Other authors (such as Mercer, 1969, 1972) come up with smaller numbers.

If the land was used to fully collateralize a comparable amount of borrowing, a

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<sup>65</sup> Jenks (1938, p.210).

railway's credit constraint would be relaxed only slightly. This conclusion may be misleading, however. Land grants were not uniformly distributed across the railways constructed in this period. They were concentrated in the period 1865-70 and were received disproportionately by certain roads, including the first transcontinental lines, the kind of risky investments that might otherwise have found it difficult to secure adequate funding. Mercer concludes that many land grants were wasted; they were given to railroads that would have been built in any case. He bases this presumption on the finding that the private rate of return exceeded the return on alternative uses of funds—in other words, that the railways still would have wanted to borrow at the prevailing rate. An asymmetric information perspective casts doubt on this conclusion, because it implies that some railways denied land grants might not have been able to access external finance at any price.

### **Social Impact**

19th century infrastructure projects dramatically reduced the costs of communication and transportation (see table 5). The contribution of external finance to project completion varied according to the wealth of the indigenous population, the density of settlement, and the ability to mobilize domestic resources. In the United States the majority of infrastructure investment was financed from domestic funds. (Even there, foreign investment could be important for certain critical sectors, such as railroads, as table 6 illustrates.) In Africa, at the other extreme, the largest share was financed externally, especially for expensive projects such as railroads.

**Table 5. Cost of Inland Transport in Selected Countries, 1800-1960 (in US cents per short ton-mile)**

	United Kingdom	France	United States	Australia (New South Wales)	India	Japan
<b>Road</b>						
1800-20	18-29	—	30-70	—	—	—
1830s	13-22	5-11	12-17	—	12	—
1860s	—	—	—	13 <sup>a</sup>	(8) <sup>b</sup>	—
<b>Canal</b>						
Early 19th Century	5-7 <sup>c</sup>	2-4	(1.7-3.4) <sup>d</sup>	—	—	—
<b>Railway</b>						
1850	(3-5) <sup>e</sup>	2.2 <sup>f</sup>	(4.1) <sup>g</sup>	—	—	—
1880	2.4 <sup>h</sup>	1.7	1.2	4.1	2.0 <sup>i</sup>	—
1900	2.0	1.3	0.7	2.3	0.9	0.9
1920	2.2	1.2	1.1	1.4	0.8	1.0
1938	2.3	1.7 <sup>k</sup>	1.0	2.0	1.0	0.7 <sup>m</sup>
1950	2.2	2.1	1.3	1.6	1.0	0.8
1960	3.3	2.5	1.4	3.6	1.1	1.6 <sup>n</sup>

Note: Road and canal figures are mostly approximate. Brackets denote incomplete figures. Railway figures refer to average receipts for goods carried by rail and are from the following dates onwards: UK 1820, France 1850, USA 1870, Australia (New South Wales) 1870, India 1900, Japan 1890.

<sup>a</sup> 1871 figure

<sup>b</sup> 1861-2 figure for cotton only

<sup>c</sup> See Jackman

<sup>d</sup> Erie Canal route, 1830-50

<sup>e</sup> Yorkshire and Lancashire railways for 1852-3

<sup>f</sup> 1851 figure

<sup>g</sup> New York State railways

<sup>h</sup> 1885 figure

<sup>i</sup> 1874 figure

<sup>k</sup> Increase from 1938 partly accounted for by new method of calculation

<sup>m</sup> 1936-7 figure

<sup>n</sup> Approximate

Source: Woodruff 1967, p.253.

In Asia, external finance was relatively small and unevenly distributed. Certain sparsely populated countries such as Malaya received large amounts of foreign investment per capita, financing almost all of their infrastructure out of foreign funds. India, operating under the guarantee, received disproportionate quantities of foreign investment. Most castes had a background unfavorable to financial involvement; hence Indians provided relatively little capital for these enterprises, concentrating instead in small-scale trading ventures.<sup>1</sup>

According to data cited by Woodruff (1967), on the eve of World War I some three-quarters of recorded investments in India had been financed by foreign investors, two-thirds of which were devoted to the railways.

**Table 6. Estimates of Long-term Foreign Investment in the United States, 1853-1874 (\$US millions)**

Date	Total	Government			Private Sector							
		Federal	State	Country/ City	Banks	Canals	Railroads	Insurance	Mining	Manufacturing	Utilities	Other
1853	222.2	27.0	111.0	21.5	6.7	2.5	52.1	0.4	0.7	0.1	0.1	
1854												
1856	241.0	15.0	111.0	21.5	6.7	2.5	82.9	0.4				1.0
1859			40.0									
1861, Jan.	444.0						100.0					
1863	200.0											
1864, Mar.		150.0										
1865, Mar.		320.0										
1865, June												
1866	600.0	350.0	←150.0→				100.0					
1867		486.0					150.0					21.0
1868	938.0	700.0	60.0			7	243.0		10.0			25.0
1869	1,390.5	1,000.0	100.0	7.5		5						
1871		845.0										
1872	1,500.0											
1873	1,500.0											
1874	1,500.0		92.9				390.0					

Source: Wilkins 1989, p. 91.

Foreign investment played a smaller role in China and Japan. In China it was concentrated in British-owned businesses, mainly trading companies, in the Shanghai area. Only one-seventh of British funds went into transport, most of it was devoted to shipping. The French contribution to infrastructure was more important: French capital financed railways connecting French Indo-China with China and penetrating into China's interior. About one-third of foreign investment in China as of 1913 was devoted to transportation. Japan was essentially closed off to foreign investment prior to 1900. Only thereafter did the government begin to float bonds on the London market to defray the cost of its wars with China and Russia and to help finance public utilities, including railroads.

European investment in Africa was driven by strategic as well as commercial motives. The former, epitomized by the French-financed Suez Canal, dominated in North Africa, while the latter was the driving force to the continent's south. There, European money financed railways and ports to open up the interior, with its diamonds and gold, and to exploit opportunities for plantation agriculture. French funds, attracted by government guarantees, financed the construction of railways and ports in Tunisia, Algeria, and Morocco (where Spanish money was also important).<sup>66</sup>

External funds also loomed large in Australia and New Zealand, both because the countries were sparsely populated and because the colonial connection helped to overcome information problems and other risks. British investors financed virtually all of New Zealand's pre-1913 public works, including the railway and harbor systems. Population increased more rapidly in Australia, facilitating some domestic finance of public works. But much infrastructure investment, in railways, ports, and urban public works, was financed through borrowing in London, particularly before 1850 and after 1880.

Recent studies of Latin America (for example, Stone 1977) have produced a detailed picture of

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<sup>66</sup> A few loans were raised directly from government agencies such as the Caisse des Depots. For details, see Kamarck (1967).

the varied infrastructure projects financed out of foreign funds. As of 1914, some two-thirds of European funds had been used to develop infrastructure, including ports, harbors, wharves, and power and water supplies. More than three-quarters of Argentina's extensive railway system was financed by foreign funds, for example. Like that of the United States, the Latin American experience disproves the idea that a current colonial connection was needed to secure access to overseas funds. As one historian wrote in the 1960s, "There are few major public works in Latin America today which do not owe their 19th- or early 20th-century origins to a decision made by one of the financial houses of London, Paris, Berlin, Madrid, or Lisbon."<sup>67</sup>

All this paints a picture of foreign infrastructure investment having a favorable influence on economic development. Analysis would not be complete, however, without mentioning negative aspects of the process. Characterizing Peronist criticism of British railway investments in Argentina, Jenks (1944) wrote, "The lines were so located that they did not facilitate communication between interior areas except by way of Buenos Aires. They were operated substantially as unregulated monopolies. Railway rates were high; they were unresponsive to local needs; they discriminated against nascent local industries and ruined existing competitors. They actively opposed highway construction, except for feeder purposes. Employees were indifferent to passengers and shippers. There was insufficient rolling stock to handle traffic expeditiously."

Such criticisms were by no means uncommon elsewhere, as demonstrated by Populist complaints about the structure of U.S. freight rates in the 1880s and 1890s. Arguably, however, these problems were more severe where foreign finance was more extensive and entailed foreign control. Jenks compares the effects of foreign investment in the growth and operation of railways in the United States

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<sup>67</sup> Woodruff (1967, p.124).



and Argentina. In the U.S., foreign finance merely supplemented domestic funds. Foreign investors rarely acquired majority stakes and operating control.<sup>68</sup> Railway management was highly responsive to local economic conditions. An efficient and reliable railway system facilitated the emergence of mass-production manufacturing techniques, notably including modern methods of inventory control, in the late 19th century.<sup>69</sup> But in Argentina, foreign finance dominated, British control of railways was often complete, and management—down to the stationmasters and engineers—was almost exclusively English. The design and operation of infrastructure projects was consequently less responsive to "local needs."

### Private Returns

The preceding discussion of the economic effects of foreign investment provides no guidance for estimating private returns. Where investment in infrastructure created positive externalities that were not easily captured by investors, private returns could fall short of social benefits. Where opportunities for price discrimination and predatory pricing were exploited by foreign-owned or foreign-controlled enterprises, in contrast, private returns to the investor might exceed benefits to the recipient country.

The qualitative literature on foreign investment in the late 19th century does not speak clearly to this question. It is replete with tales of failed projects and disastrous investments—all cases with low returns on purchases of common stock. A prototypical case is the Canadian Grand Trunk Railway,

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<sup>68</sup> The main exceptions occurred in the wake of default, when representatives of foreign bondholders might demand effective control of management. In addition, certain British banking houses had an important influence on management. See Wilkins (1989, p.209, 218 and *passim*), who reports examples such as the St. Louis and Iron Mountain Railroad, in which Barings acquired a large stake, prompting Thomas Baring at one point to go to the United States in an effort to change the company's management.

<sup>69</sup> For details, see Chandler (1990).

whose financing was described in the section on government guarantees. Despite successive reorganizations extending over the second half of the 19th century, the Grand Trunk was not able to pay a single cent of interest either on its common stock or on the preferred shares into which the original debentures were converted in 1862. By 1865 Grand Trunk shares were selling in London at 22 percent of par.<sup>70</sup>

Nor were defaults and losses on bonded debt uncommon. "Many American railroads had been financed almost entirely by bond issues, and in consequence had experienced great difficulty in avoiding bankruptcy and receivership during periods of low earnings."<sup>71</sup> Not even government backing guaranteed security; U.S. states that backed bonds for financing infrastructure investments defaulted in the 1830s and 1840s. The same was true of French and German loans to the Greek and Turkish governments and of British loans to the City of Buenos Aires, all undertaken in part to fund infrastructure investments (Fishlow, 1985).

The returns on overseas investments have been studied most systematically for Great Britain. (The distribution of British overseas investments in 1913 is shown in table 7.) Edelstein (1981) tracks a sample of British equities and debentures (bonds) over the period 1870-1913. His sample is comprised of first- and second-class publicly traded securities. He finds that British foreign and overseas equity investments consistently outpaid equity investments in the same sectors domestically. Equity investments in Indian, Latin American and U.S. railways yielded a higher return than British investment in domestic railways. Investment in foreign and overseas gas works consistently yielded a higher return than investment in gas companies at home. After 1886 investment in foreign and overseas telegraph and

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<sup>70</sup> See Jenks (1938, p.202-203); Easterbrook and Aitken (1961, p.317).

<sup>71</sup> Easterbrook and Aitken (1961, p.432).

telephone companies outpaid investments in competing domestic companies. Returns on investment in foreign and overseas tramways outstripped those on domestic tram companies after 1876. Much of this difference is plausibly attributable to the greater riskiness of foreign and overseas investment, as Edelstein demonstrates. But for investors able to diversify away the unsystematic risks associated with particular foreign investments (through reliance on investment trusts, for example), the foreign equity premium clearly sufficed.

**Table 7. British Overseas Investment in Publicly-issued Securities, December 1913**

	£million	Percent
Government and municipal	1,125.0	29.9
Dominion and colonial governments	675.5	17.9
Foreign governments	297.0	7.9
Overseas municipalities	152.5	4.1
Railways	1,531.0	40.6
Dominion and colonial railways	306.4	8.1
Indian railways	140.8	3.7
United States railways	616.6	16.4
Other foreign railways	467.2	12.4
Other public utilities	185.1	5.0
Electric light and power	27.3	0.7
Gas and waterworks	29.2	0.8
Canals and docks	7.1	0.2
Tramways	77.8	2.1
Telegraphs and telephones	43.7	1.2
Commerce and industry	208.5	5.5
Coal, iron and steel	35.2	0.9
Breweries	18.0	0.5
Other commercial and industrial	155.3	4.1
Raw Materials	388.5	10.3
Mines	272.8	7.2
Nitrates	11.7	0.3
Oil	40.6	1.1
Rubber	41.0	1.1
Tea and coffee	22.4	0.6
Banks and finance	317.1	8.4
Banks	72.9	1.9
Financial, land and investment	244.2	6.5
Miscellaneous	8.1	0.3
<b>Total</b>	<b>3,763.3</b>	<b>100.0</b>

Source: Thomas 1967, p.14.

The behavior of bond yields was different. Returns on British and foreign railway bond yields fluctuated inversely in the manner predicted by the Kuznets Cycle long-swing model. In one decade, British yields exceeded U.S., Canadian, and Latin American railway bond yields, while in the next decade the opposite pattern prevailed. Over the entire 1870-1914 period, average returns on domestic and foreign bonds appear to have been quite similar, suggesting a roughly comparable degree of risk despite variation in timing of events affecting yields. Only Indian bond yields failed to fit the pattern. The guarantee against default was virtually complete in India, as was the ability to arbitrage against other assets on the London capital market. British and Indian railway bond yields consequently fluctuated in tandem.

Thus, Edelstein's calculations yield evidence of a reasonably efficient international capital market, in which investors arbitrated between alternative assets and demanded compensation for exceptional risks. None of his findings are inconsistent with the view that investors did this in the face of information costs that gave rise to adverse selection and moral hazard. These problems limited the ability of potential borrowers to raise funds on the London market despite the prevalence of government intervention.

### **Conclusions and Implications for Present-Day Developing Countries**

Recent suggestions for innovative solutions to the problem of financing infrastructure investments in developing countries have a back-to-the-future quality. Relying on private finance, encouraging the growth of domestic financial markets that could play a larger role in

infrastructure investment, and choosing financial instruments so as to minimize the risks of dependence on foreign funds—these ideas were at the heart of the debate over financing infrastructure investments, most notably the railways, in the 19th century. Thus, the historical record is replete with information on both the circumstances under which such innovations are workable and their limitations.

In middle-income developing countries, these methods have much to recommend them. Formal financial markets and prudential regulation are relatively well advanced. The information requirements for efficient use of private and commercial finance are approximated if not fully met. Private initiative, commercial bond and equity finance by public agencies, and limits on government guarantees could deliver at least some of the benefits trumpeted by their advocates.

In less developed and less-liberalized economies, in contrast, not all the informational and contractual preconditions for efficient private or commercial finance of infrastructure projects prevail. As in regions of recent European settlement and elsewhere in Latin America, Africa and Asia a century and more ago, it will be difficult to mobilize resources by tapping investors at home and abroad. Private institutions (universal banks, for example) and public ones (such as regulatory agencies) are needed to insure an adequate flow of information to investors, to facilitate monitoring, and to discipline management; these are not yet in place in many developing countries. With time, financial liberalization and policies to encourage the growth of the formal financial sector can help to overcome these problems. But in the meantime, the hope that all problems of infrastructure finance can be dispatched through the adoption of policies friendly to private and commercial initiatives must be

dismissed as naive.

So the history of infrastructure investment in the 19th century suggests. In places otherwise as different as the United States, Canada, Spain, and India, the informational asymmetries characteristic of developing financial markets hindered efforts to rely on private finance. Funds adequate to underwrite the construction of canals, railways and ports could not be mobilized through the operation of private financial markets alone, owing to the adverse selection and moral hazard resulting from asymmetric information. This was true of attempts to access domestic and external financial markets alike. Obtaining adequate finance required government intervention in the form of the provision of collateral (land grants) and bond guarantees. This was necessarily—and, in principle, desirably—the case in a situation where asymmetric information caused credit rationing.

Then as now, however, government intervention could simply replace one set of problems with another. Access to private markets was restored courtesy of the government, allowing promoters to seal sweetheart deals with construction companies that left taxpayers holding the bag. Government guarantees might render irrelevant the information problems that hindered investors' efforts to evaluate the commercial prospects of infrastructure projects, but they did not provide effective mechanisms of public administration to monitor the uses of external funds and protect the public interest. Where governments made least progress in solving these problems, undesirable outcomes ultimately drove them to public construction and operation of railways and other infrastructure projects.

The message for policymakers is clear. Exploiting nontraditional approaches to financing infrastructure investment requires action on two fronts: initiatives to liberalize and

**develop domestic financial markets, and reforms of administrative mechanisms designed to ensure the accountability of enterprises subsidized by or enjoying guarantees from the government. Neither reform will work in isolation from the other.**

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1. The establishment of a few large enterprises, in iron and steel for example, should not be neglected. For a nuanced discussion, see Sinha (1946). A similar generalization applies to Indonesia, Malaya, Siam, Indo-China, the Philippines, Burma, and Ceylon.

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